BEI SENSORS

Functional Safety incremental encoders

Up to SIL3
and PLe

Functional Safety Type Approved
TÜVRheinland CERTIFIED
www.tuv.com
ID 0600000000

Mastering speed control

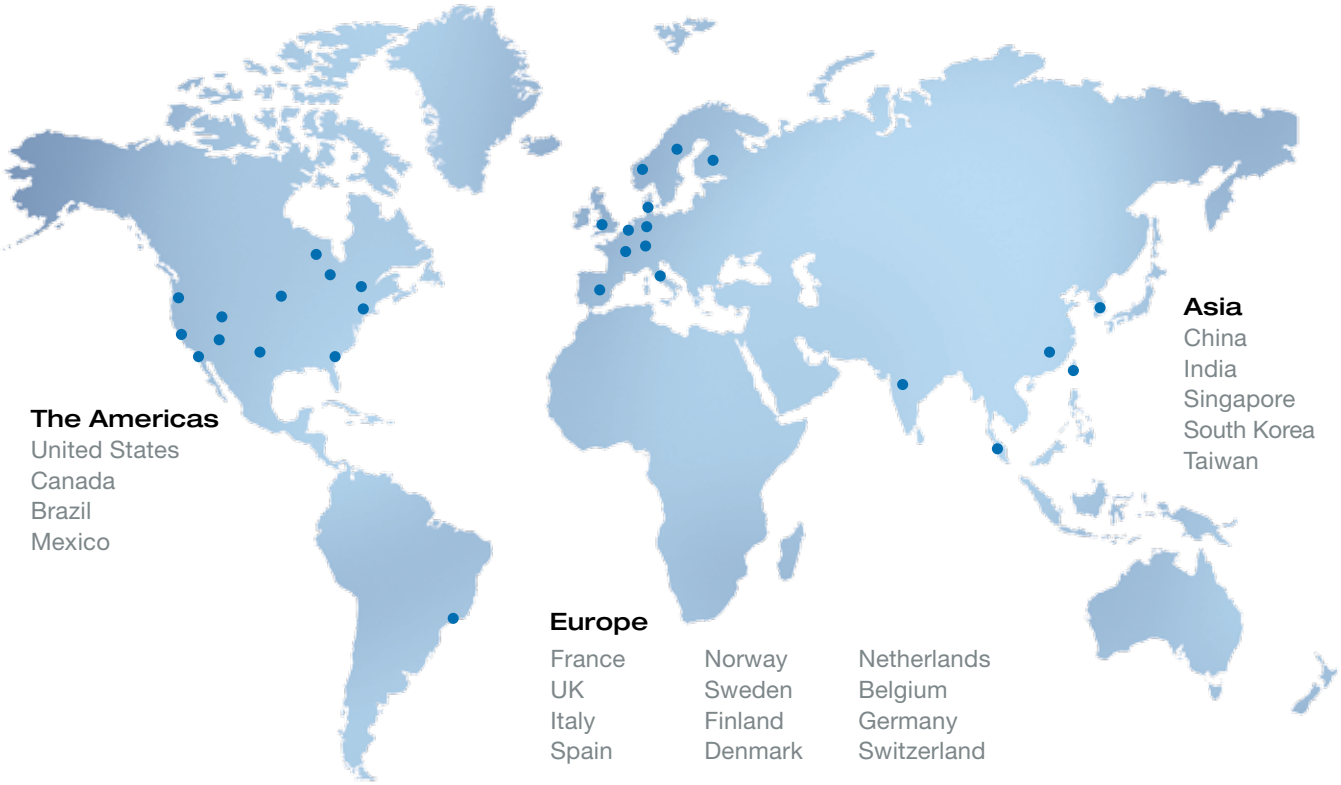
About BEI Sensors

BEI Sensors production centre in Strasbourg, France

BEI Sensors specialises in speed and position sensors for extreme applications. With an extensive product offering including optical and magnetic encoders, Hall effect sensors, and potentiometers, BEI Sensors offers standard configurations to completely customised solutions. Through uncompromising quality, performance, and reliability, BEI Sensors upholds a standard of excellence in its products, customer service experience, and commitment to being a global leader in sensor technology.

BEI Sensors was formed in 2010 as a merger between the BEI Industrial Encoders, BEI Duncan Electronics and BEI Ideacod brands.

BEI Sensors is a brand of Custom Sensors & Technologies (CST).



About CST

Custom Sensors & Technologies (CST) is a specialist in designing and manufacturing sensing, control and motion products.

Through its brands, BEI Kimco, BEI Sensors, BEI PSSC, Crouzet, Crydom, Kavlico, Newall and Systron Donner Inertial, CST offers customisable, reliable and efficient components for mission-critical systems in Aerospace & Defence, Transportation, Energy & Infrastructures, Medical, Food and Beverage and Building Equipment markets.

Focused on premium value offers and committed to excellence, CST, with 4500 employees worldwide and sales of $600 M US in 2013, is the dependable and adaptable partner for the most demanding customers.

www.cstsensors.com

The basics of safety standards, SIL and PL levels, SISTEMA

Functional Safety: this logo identifies all BEI Sensors products with functional safety certification.

Any automated system potentially poses a risk to people, property or the environment. For this reason a number of safety measures have been taken. Safety standards have been created with one thing in mind: limiting risk.
With these standards as a framework, functional safety can, after a risk analysis, provide appropriate protection. Hazards are anticipated during the system design phase and are dealt with before they occur.
These standards have evolved to increase the safety level and have been applicable since 2012.

Standards

IEC/EN 61508 (2010)

This standard, specific to control systems, incorporates safety regulations, technical specifications and the training of personnel, taking into account the life cycle applied to safety.
It has replaced standard EN 954 since November 2009.

IEC/EN 62061 (2013)

This standard derived from standard EN 61508 is applied to machinery.
It defines requirements and gives recommendations for the design, integration and validation of safety-related electrical, electronic and electronically programmable control systems for machinery.

EN ISO 13849-1 (2009)

This standard covers the electrical safety of control systems (hydraulic, pneumatic, mechanical).
Standard EN 62061 supplements standard EN ISO 13849-1.

SIL/PL levels

The concepts of Safety Integrity Level (SIL) and Performance Level (PL) come from the above standards. They describe the capacity of the control system, in terms of safety, to reduce the risk factor.

PFD (Probability of Failure on Demand)	PFH (Probability of Failures per Hour)	SIL EN 61508 EN 62061	PL EN 13849-1	Risk reduction factor
$10^{-2} < PFD < 10^{-1}$	$10^{-6} < PFH < 10^{-5}$	1	b, c	10 to 100
$10^{-3} < PFD < 10^{-2}$	$10^{-7} < PFH < 10^{-6}$	2	d	100 to 1000
$10^{-4} < PFD < 10^{-3}$	$10^{-8} < PFH < 10^{-7}$	3	e	1000 to 10,000

SISTEMA

SISTEMA is free software, available on the Internet. It is a vital tool for users, which provides full support in evaluating safety devices on machines in the context of standard EN ISO 13849-1.

This tool is based on two key features:

1. It provides assistance in defining the Performance Level (PL) required for a safety installation.
2. It can be used to model the structure of the safety system down to the component level, in accordance with standard EN ISO 13849-1. SISTEMA therefore makes calculations to check that the required PL and obtained PL match, depending on the safety data of the components used in the system.
   Libraries of components with safety data are made available on manufacturer sites.

The library of BEI Sensors safety encoders and standard encoders, as well as the SISTEMA software are available for download from **beisensors.com**

The safety values for BEI Sensors encoders make it much easier to integrate them in a high-performance safety system (up to PLe category 4).

The new range of incremental encoders: up to SIL3/PLe Cat. 4

In response to customer demand for functional safety, BEI Sensors, a leading manufacturer of encoders and position sensors, has developed a range of functional safety encoders to suit a wide variety of industrial applications.
This new range of encoders can be used in safety applications involving speed control with or without rotation detection as well as position counting applications.
The associated drive safety functions are: SLS, SSM, SLA, SAR, SDI, SS1/SS2, SOS, SLP, SEL, SLI, SCA.

	Model	Characteristics	Shaft type	Shaft diameter	Resolution	Max. speed	Termination
	DSM5H	58 mm Aluminium IP65		6, 10 mm and 3/8”	250, 256, 360, 500, 512, 1000, 1024, 2048, 2500	6000 RPM	Cable or M23 Connector Axial or Radial
	DSM5X	58 mm Stainless steel IP69K		10 mm	250, 256, 360, 500, 512, 1000, 1024, 2048, 2500	3000 RPM	Cable Axial
	DSO5H	58 mm Aluminium IP65		14 mm	250, 256, 360, 500, 512, 1000, 1024, 2048, 2500	4000 RPM	Cable or M23 Connector Radial
	DSM9H	90 mm Aluminium IP65		11, 12 mm	1024, 2048	6000 RPM	Cable or M23 Connector Axial or Radial
	DSM9X	90 mm Stainless steel IP66		11, 12 mm	1024, 2048	6000 RPM	Cable or M23 Connector Axial or Radial
	DSU9H	90 mm Aluminium IP65		20, 25, 30 mm and 1”	1024, 2048	3000 RPM	Cable or M23 Connector Radial
	DSU9X	90 mm Stainless steel IP66		20, 25, 30 mm and 1”	1024, 2048	1500 RPM	Cable or M23 Connector Radial

Shafted Through shaft

All these versions are available with the following electronics

Electronic with digital or analogue outputs		
Interface type	**Supply**	**Output signals**
Digital	5 VDC or 11-30 VDC	TTL/RS422
	11-30 VDC	HTL Push-Pull
Analogue	5 VDC or 11-30 VDC	Sin/Cos 1 Vpp

The technical data sheets and assembly instructions for these products can be downloaded from our website **beisensors.com**

The “Functional safety user manual” is available on request.
Please contact Customer Service:
+33 (0)3 88 20 81 00 or
info@beisensors.com

Innovations of the range

The robust and reliable design of BEI Sensors functional safety incremental encoders results in a wide range of secure products, which can be used in several types of configuration.
Adaptable and safe, BEI Sensors functional safety encoders offer solutions which comply with current safety standards. By using a high-performance differential optical reading system combined with built-in diagnostic functions, BEI Sensors functional safety encoders offer a higher safety level than standard encoders.

Numerous technical characteristics adapted to your requirements!

- A range of products to European standard 58 mm and Heavy Duty 90 mm with solid or through shaft packages.
- Fully interchangeable (mechanically and electronically) with standard models.
- Stainless steel housings for severe offshore, marine or food & beverage environments.
- Protection ratings available from IP65 up to IP69K for extreme environments.
- Numerous resolutions up to 2500 points/rev to match the product as close as possible to the drive chain.

BEI Sensors offers a range of encoders with conventional Sin/Cos analogue outputs and exclusively TTL and HTL digital outputs, up to SIL3/PLe.

Sin/Cos 1 Vpp

TTL/RS422 or HTL Push-Pull

Designed for maximum robustness and safety

Drive secured with a key.

Insulating reduction sleeves to protect against leakage currents, fitted with interlocks.

For through shafts, a single device secures slippage with locking pins.

Robust mechanical construction with additional bearing housed in the cover.

A range of flanges, stator couplings and tether arms makes it easy to integrate encoders on your equipment.

PRODUCT CERTIFIED BY TÜV RHEINLAND

Complementary products - Safety modules

In addition to the functional safety encoder range, BEI Sensors offer modules providing safety functions.

Main module	Encoder module	Relay module
Safety controller	Incremental encoder interface	Safety relay
This PLC combined with complementary modules is an alternative for integrating safety functions in a simple system or for bringing one into conformity. The safety function parameters are set via dedicated graphic software.	Acquisition and secure monitoring of the encoder signals. Safety functions performed: zero speed, overspeed, speed range and direction of rotation.	Securely breaks a power circuit up to 6 A/250 V Addressable via the main module.
Up to SIL3/PLe	Up to SIL3/PLe	Up to SIL3/PLe
24 VDC power supply 8 digital inputs 2 x 2 secure solid state outputs	24 VDC power supply 1 encoder input with 2 complementary channels	24 VDC power supply 2 x 2 safety relays (cat. 4) , 4 NO + 2 NC 6 A - 250 V
Part no: NEG0003000	Part no: NEG0003001: for Sin Cos encoder Part no: NEG0003002: for TTL 5 V encoder Part no: NEG0003003: for HTL 11/30 V encoder	Part no: NEG0003004

Shaft speed monitoring example:

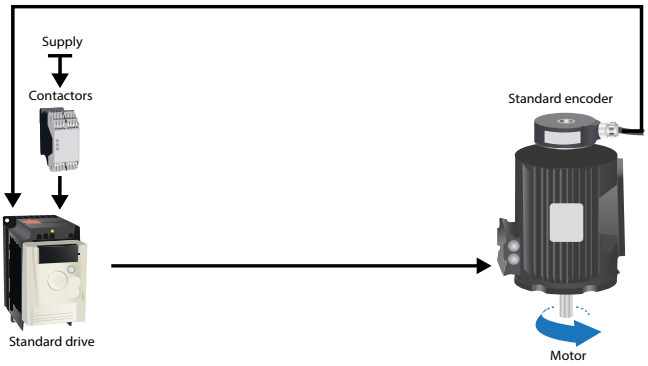
1 main module (Part no: NEG0003000) + 1 HTL encoder module (Part no: NEG0003003) + 1 HTL safety encoder BEI Sensors (DS…-xxxx -xxx) + 1 relay module (Part no: NEG0003004)

Note:

The main module is always combined with one or more other modules. Modules communicate with one another via a built-in bus. See the technical documentation for more details.
Please contact us if you require other modules and accessories.

Examples of architectures

Encoders for monitoring speed in a safety system can be integrated according to various different configurations. Depending on the safety level and/or the existing equipment, different solutions are illustrated below.



Non-safety certified installation

Safety level: 0

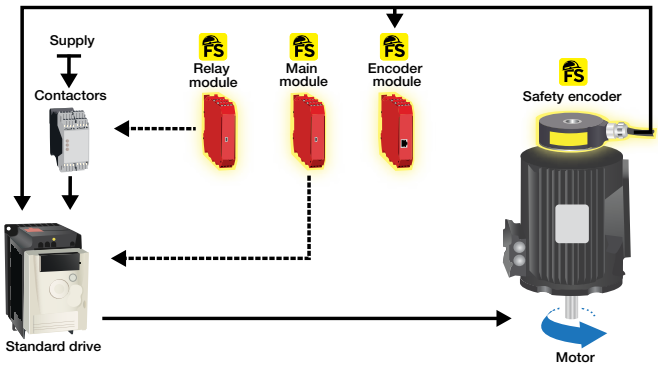
Retrofitting Existing Equipment

Ease of integration: n/a | Low-cost solution: n/a

New design

Ease of integration: n/a | Low-cost solution: n/a

n/a: not applicable



Modular safety solution

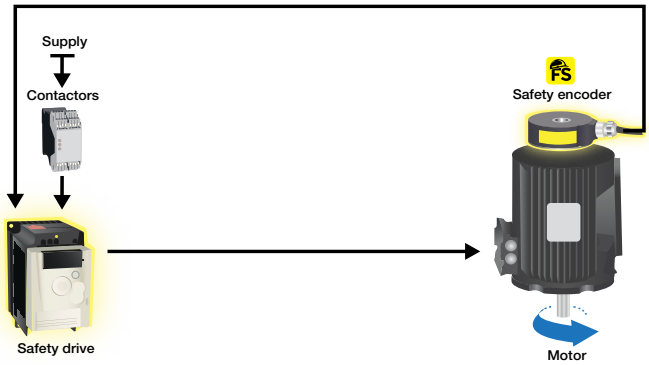
Safety level: up to SIL3/PLe

Retrofitting Existing Equipment

Ease of integration: +++ | Low-cost solution: +++

New design

Ease of integration: ++ | Low-cost solution: ++



Built-in safety solution

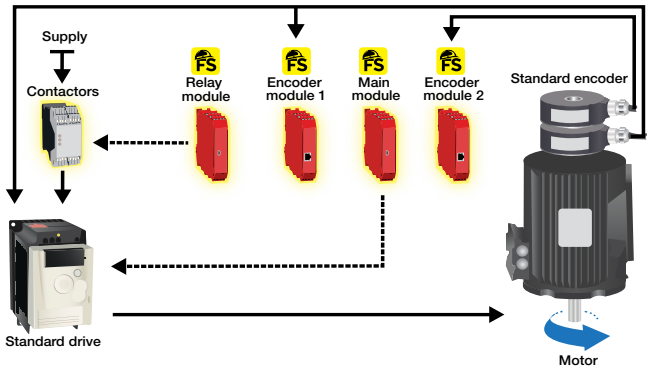
Safety level: up to SIL3/PLe

Retrofitting Existing Equipment

Ease of integration: + | Low-cost solution: +

New design

Ease of integration: +++ | Low-cost solution: +++



Redundant safety solution

Safety level: up to SIL2/PLd

Retrofitting Existing Equipment

Ease of integration: ++ | Low-cost solution: ++

New design

Ease of integration: + | Low-cost solution: +

Note: The use of encoders in a safety system requires external monitoring of the encoder signals. More information about these prerequisites can be found in the “Functional safety user manual” and in the “Installation manual”. The safety modules offered by BEI Sensors satisfy these requirements transparently for the user.

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